Response to Comments by William Walker and Robert Kadlec
Prepared for the U.S. Department of the Interior
Memorandum Dated September 20, 2002

Note: While the comments from Drs. Walker and Kadlec were not numbered, for ease of reference, their comments are paraphrased and responses provided herein.

Modeling

Comment 1. Recommend the use of the Non-Emergent Wetland System (NEWS) calibration data set for simulating SAV communities.
Response: Scientific uncertainty remains regarding the long-term performance of submerged aquatic vegetation (SAV). The District will continue to investigate ways to optimize SAV performance. After review of the available calibration sets and based on the professional opinion of Tom DeBusk, the District elected to use SAV_C4 as the primary SAV calibration set and also included the use of the recommended NEWS calibration as a sensitivity analysis.

Comment 2. Uncertainty remains in the development and sustainability of an SAV system that can replicate the Cell 4 1998-99 period.
Response: Agree. Replicating the performance of SAV in Cell 4 remains a high priority.

Comment 3. The alternative projections based on NEWS should be clearly presented and explained in the reports, including side-by-side presentation of the SAV_C4 and the NEWS results.
Response: The final reports contain side-by-side presentation of results.

Comment 4. Further improvements to DMSTA should yield more accurate forecasts of phosphorus performance.
Response: We look forward to these model refinements.

Evaluation Criteria

Comment 5. Criteria other than performance and cost are redundant and add more confusion than substance.
Response: While performance and cost are primary criteria, the methodology used a comprehensive set of criteria and included those specified by the Everglades Forever Act, including cost-effectiveness.

Comment 6. The BSFS design strategy is based solely on the geometric mean.
Response: The BSFS is not a design document, rather, it is a planning level evaluation of alternatives that utilizes the best available information. While a planning level target of 10 ppb geometric mean was used in the evaluation, the flow-weighted mean was also an explicit evaluation criterion. Both values are used in discussions regarding future plans.

ECP Basins

Comment 7. Same as Comment 3 above.

Comment 8. Figure 2-9 demonstrates the concern about the optimism of SAV_C4.
Response: Scientific uncertainty remains regarding the long-term performance of submerged aquatic vegetation (SAV). The District will continue to investigate ways to optimize SAV performance. There were many factors that are not able to be modeled using DMSTA that influenced phosphorus performance during the period used to calibrate STA-1W, including a severe drought, stabilization of Cell 5B, and significant disruptions to the vegetation in Cell 2 (upstream of Cell 4).

Comment 9. Calibration of DMSTA hydraulic coefficients needs more clarification.
Response: The final report contains additional clarification on the hydraulic coefficients.

Comment 10. Lack of regional calibration data sets is the major uncertainty associated with forecasting reservoir performance.
Response: Agree; also, the lack of proposed reservoir operating strategy is another significant uncertainty.

ESP Basins

Comment 11. The section on uncertainties should discuss the source of the major uncertainty – the SAV calibration.
Response: The final report includes a discussion of the SAV calibration data.

Comment 12. The draft report mischaracterized the NEWS data set.
Response: The final report revised the description of the NEWS data set.

Comment 13. SAV_C4 and NEWS projections are not shown side-by-side in the summary tables.
Response: The final report presents side-by-side results of SAV_C4 and NEWS in the summary tables presented in the Executive Summary.

Comment 14. If 10 ppb could not be achieved, then the lowest geometric mean reported by the model was reported. It is not clear that this is consistent with the framework and objectives of the BSFS.
Response: In those basins with existing lands in public ownership, alternatives were identified that limited the size of the treatment facilities to the available footprint. However, in these instances estimates of expanded area were projected if the long-term geometric mean of 10 ppb was not met within the available footprint.

Comment 15. (This comment concerned dry deposition rates and was subsequently retracted by Bill Walker.)

Comment 16. The draft report did not address the uncertainty associate with seepage estimates.
Response: A new section addressing uncertainty associate with seepage estimates was added to the final report.

Comment 17. The sensitivity analyses indicate that DMSTA projections are most sensitive to the inflow load (inflow fraction).
Response: Agree.

Comment 18. Diverting ACME Basin B flows to STA-1E without increasing its area may reduce the flexibility and capacity for treating runoff from other ECP basins.
Response: Agree; it is the intent of District staff to reserve use of the 375-acre parcel located south of and adjacent to STA-1E for possible expansion of STA-1E if needed.

Comment 19. The notion that increasing the phosphorus load to STA-1E will not increase the phosphorus outflow concentration is misleading.
Response: Agree; this occurs for both the SAV_C4 and NEWS data sets, with 10 ppb and 11 ppb, respectively.

Comment 20. The phosphorus data set for the C-51W basin used in the BSFS was quite limited, and as a result, STA-1E may be less able to absorb pulses than indicated by the current projections.
Response: Agree, we will monitor the response of STA-1E when it becomes operational. It is the intent of District staff to reserve use of the 375-acre parcel located south of and adjacent to STA-1E for possible expansion of STA-1E if needed.

Memorandum

To: **Gary Goforth**
South Florida Water
Management District

Date: October 14, 2002

From: Tom DeBusk
DB Environmental, Inc.

Subject: Thoughts on SAV communities and STA performance

A key assumption for the recent basin specific feasibility analyses is that SAV communities will provide superior phosphorus (P) removal performance to emergent communities. A second important assumption is that SAV communities have the ability to reduce total P concentrations to 14 μg/L (on an annual flow-weighted mean basis). The first assumption has been verified by analysis of several years of data collected primarily at STA-1W, using various platforms ranging from mesocosms to full-scale STA wetlands. The second assumption is based on two years of performance by a 140 ha SAV wetland (STA-1W Cell 4), and 16 months of performance data (May 2001 – August 2002) of SAV mesocosms located at the STA-1W south supplemental technology site.

There still remains disagreement over the exact data sets and model configurations to be used for predicting STA footprints and performance. Area requirements and predicted outflow concentrations vary widely, depending on what model configuration is selected, and what data are used for calibration. At issue is the uncertainty surrounding the footprint needed to achieve the outflow water quality goals. One model configuration suggests that the existing STA footprints are adequate to achieve target concentrations, whereas a second configuration suggests a moderate amount of additional land is needed.

While I agree that this is an important issue to resolve, an issue of even greater importance lies in our ability to effectively promote and maintain the desired SAV communities. To put things in perspective, I'd like to list a few key items, under a column of "knowns" and "unknowns" (my opinions).

Knowns

- If the STAs (at least those built on previously farmed sites) are allowed to develop "passively" as a mosaic of floating, emergent and submerged communities, TP outflow concentrations won't even come close to approaching the desired 10 – 15 μg/L outflow levels. Wetland size doesn't matter here: no matter how big the footprint, the predominant emergent community in an STA won't meet those concentrations.

- SAV communities, by contrast, have met concentrations in the 14 –15 μg/L range for prolonged periods. Most importantly, this has been accomplished at a large scale (140 ha Cell 4).

- The Cell 4 SAV community has persisted for 9 years, which suggests reasonable sustainability by SAV at the operational scale. Additionally, during 2002 the submerged community, particularly in the outflow region of the Cell 4, has shown to be robust to the wide depth ranges (max. depths of 5') and flow pulses that are now a routine component of STA operations.

- No other STA vegetative community seems likely to exceed SAV performance. The only periphyton-based system to consistently attain 10 μg/L was the 9 cm deep mesocosm raceway that we developed on limerock. This shallow community likely cannot be duplicated at an operational scale. Periphyton communities developed on muck substrates appear to convert into SAV or emergent systems, depending on water depth.

- In an SAV wetland, P removal performance suffers if the vegetation becomes unhealthy or dies. For example, SAV wetlands in which the submerged plants become shaded by floating macrophytes do not perform well. We observed this in the north test cells, where duckweed covered much of the inflow region SAV community in response to high hydraulic loads. Both STA-1W Cell 5 and STA-5 Cell 1B have been plagued with expansive mats of water hyacinths during the past year. These floating mats have adversely affected health of SAV as well as SAV performance. As an additional example, the inflow region of Cell 4 has exhibited a recent die-off of SAV. This may be due to scouring in the short-circuit zones, or perhaps turbidity generated by the floating mats of emergent vegetation in Cell 2. Regardless of the cause, the P removal performance of Cell 4 (particularly at G-309) recently has declined.

<u>Unknowns</u>

- We don't understand why SAV communities, and indeed, individual SAV species, have exhibited variable levels of P removal performance. The SAV south test cells that contained *Chara zeylanica* provided mediocre performance. South site mesocosms containing this species, however, have provided an average outflow TP concentration of 14 μg/L for the past year. "Topping out" of the *Chara*, where a dense mat forms on the surface, appears to hinder P removal.

- When water column concentrations attain extremely low levels (sub 15 μg/L), we don't yet understand why the SAV isn't replaced by calcareous periphyton. While this "replacement" seems like a logical ecological succession (and indeed, is the basis for the DMSTA NEWS calibration), we have yet to observe this phenomenon on any muck based experimental platform. Even NTC-14, which is an SAV-dominated test cell being fed waters with extremely low TP

concentrations (ca. 11 μg/L, achieved by chemical treatment), has not been colonized to any extent by calcareous periphyton.

- We haven't yet defined the appropriate "palette" of SAV species suitable for inflow and outflow regions. *Potemogeton* is a promising plant that I feel should be encouraged (inoculated) throughout more of the STA SAV communities. Testing of the P removal performance of hydrilla, a plant that has proven very competitive in many STA cells, currently is underway.

How We Should Proceed

In my opinion, our overriding priority should be to learn, as quickly as possible, how to promote and maintain a healthy crop of SAV, under various STA nutrient regimes (inflow vs. middle vs. outflow regions) and various pre-existing conditions (cattails, floating plants, native emergent communities).

As part of this effort, we need to define how SAV will perform on waters that differ markedly in chemistry (calcium, P speciation characteristics) from STA-1W, where all previous testing has been performed.

Failure at successfully addressing SAV sustainability has far-reaching implications. If we decide that the "desired" SAV communities cannot reasonably be maintained in the STAs, and that we must fall back on totally "passive" management of these wetlands (where likely a mosaic of emergent, floating and submerged communities will develop), then for many of the STAs we must accept outflow concentrations markedly higher than 15 μg/L. It therefore is imperative that we significantly improve our understanding of SAV ecology in the STAs. As this effort proceeds, we also will better define the ultimate P removal capabilities (and hence, area requirements) of large-scale SAV wetlands.

Response to United States Department of the Interior
Letter Dated September 24, 2002

USDOI staff provided comments to the draft *Everglades Consolidated Report* and asked that the District also consider those comments on chapter 8A that are relevant to the Basin-Specific Feasibility report, specifically, numbers 1, 2 and 3.

Comment 1. The District should continue STA optimization research, including optimization with CERP Projects.
Response: It is the District's intent to continue research and STA Optimization efforts to address the remaining scientific engineering and scientific uncertainties. District staff will continue to coordinate with CERP Project Development Teams to ensure that CERP projects, e.g., the EAA Reservoir, consider ways to optimize phosphorus reductions in concert with the STAs and other water quality projects.

Comment Nos. 2 and 3. The 2-year Cell 4 SAV calibration data set is optimistic and the NEWS data set is more realistic.

- Scientific uncertainty remains regarding the long-term performance of submerged aquatic vegetation (SAV). The District will continue to investigate ways to optimize SAV performance. A recent memorandum by DB Environmental, Inc., discussing this issue was provided as comments to the basin feasibility studies.
- The DMSTA modeling work performed by the consultants used the SAV_C4 calibration set, and sensitivity analyses were performed using the NEWS data set.